

On the Dynamics of Astrocytes with Regard to Processing Music and the Role of Certain Types of Music in Exacerbating Bipolar Personality Disorder; Lithium as a Pathway Primer

14 July 2022

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Introduction

Sixth-century Chinese philosopher Shu Ching said of music, "For changing people's manners and altering their customs there is nothing better..."

The power of music to not only affect mood but to shape personality and inform morality has been recognized by many philosophers in all ages and all parts of the world. Comprehending music is a uniquely human capability; one considered by neurologists to be a global process. Although the process of translating sounds into electrical signals that the brain as a whole can understand is the responsibility of the auditory cortices, nearly all of the brain is required to appreciate music in all of its dimensions.

Abstract

Current doctrine on the neurochemical dynamics of BPD suggest that BPD sufferers have abnormally high ratios of white matter to gray matter (closer to 20% rather than the typical 10%) and that white matter is capable of sequestering lithium which, in order to perform its function, needs to be freely floating and not accumulated in clumps, which, it is believed, is what is going on in the white matter of people with BPD. Assuming that this premise is fundamentally sound, to take our understanding of BPD to the next level, we need to understand the role of lithium and which types of processes are most demanding of it. I propose that comprehension of music is a process that must demand and consume a certain amount of free-floating lithium within the brain and that specific patterns of notes may actually consume substantially more of this element than others, something which would explain how manic and hypomanic episodes can be musically triggered and how the musical tastes of BPD sufferers can be shaped by their disorder.

If this is so, it may be the case that musical taste could be used to identify BPD sufferers and could be used to gauge the mental state of a patient at any given time (if true, of course, it would mean that the musical test would risk triggering an episode, oddly enough.)

Lithium ions have the capability of accumulating and transferring electrical charge which makes them ideal for any neural process that demands that a specific pattern of electrical current be stored or repeated. Prior to an acoustic cue, if it can be anticipated, the brain can prime the neural pathways to "pre-activate" which would involve transferring electricity to lithium ions (positively charged) to reduce the effort needed to send a signal if the signal needed can be anticipated. Unlike an electrical signal, electron-laden lithium atoms require time to migrate to their target pathways. Once in place, these negatively charged lithium atoms essentially line the walls of axons and ease

the flow of electrons through those pathways.

The brain, I believe, most strongly initiates this anticipatory "priming" of these pathways in response to a series of distinct, single notes that climb up and down the Parsons Scale in such a way that maximum contrast exists between the notes. Although these sorts of note progressions seem simple and easy to anticipate, each distinct frequency activates one particular set of neurons. If we could map these neurons, we would find that there are neurons spread throughout the entire brain that activate when a C Major key is struck on a piano, but that a distinct group of neurons is activated by D, E, F, etc.

Certain pieces of music have that roller coaster pattern that meanders downward and then back up again, eventually winding up back at the note at which the music phrase began. Examples include Van Morrison's "Moondance" and the theme song to the 1990s cartoon, "Pepper-Ann." Every time I run into someone with Bipolar Disorder, they seem to like these two songs a lot more than they should. While anecdotal, these sorts of observations can be meted out by study to reinforce my theory.

I propose that what is occurring is that the playing of these sorts of tunes forces the brain to utilize large quantities of lithium which is already in short supply in the brains of those with BPD since these distinct pathways need to be repeatedly primed and re-primed. In order to effectively prime a pathway so soon after flooding the arm of an astrocyte with lithium (-) the brain must then pump even greater quantities of lithium into the next astrocyte in the sequence in order to make sure that the signal travels down that path instead of the first. This leads to an escalating usage of serum lithium culminating in some cases in manic episodes.

Since individual astrocytes consist of several arms, one might suspect that each arm is associated with a specific note or frequency, however, since not all astrocytes have the same number of arms and there are more notes on Western musical scales than there are arms on an astrocyte, it stands to reason that the astrocytes only care about the relative changes to the notes. Thus, regardless of the scale used, the brain's anticipatory mechanisms rely on a system much more akin to the Parsons Scale than anything else. While yes, the brain as a whole can remember entire songs and yes, there are many dimensions to music the brain considers, when it comes to pathway priming in relation to conveying basic information about pitch (inflection,) the only thing it cares about is what the next note is relative to the previous.

The brain, many respects, responds only to changes to stimulus and does little work in response to consistent or repeated identical stimuli. In the case of "roller coaster songs" for lack of a better way of describing them, these note progressions may play a decisive role in both identifying and even triggering this specific type of chemical imbalance.

Once in a manic state, a manic person will tend to enjoy it so much that they will seek any sensory input that furthers that state in intensity or duration, even if it is unhealthy. When you think of this phenomenon, think of someone who gets high from oxygen deprivation e.g. huffers. A normal, ordinary person would not seek pleasure in doing damage to themselves, however a person

already in an altered state may come to associate that damaging act with pleasure since it knows that pleasure tends to come in association with that act.

As BPD is associated with pathological lying in which the person is actually unable to distinguish between things that actually happened and lies they tell themselves, this deficit of lithium and lithium's role in determining the pathway that a signal takes in the brain may explain this inability to distinguish fact and fiction. It may be that there is a special section of the hippocampus dedicated in a neurotypical mind dedicated to biographical/experiential information and another dedicated to fantasy. If the forks in the proverbial road deviate in path only slightly, even in a healthy brain, lithium may make the difference between signals getting to their intended destination and arriving in the wrong section of the hippocampus. Electricity tends to follow the path of least resistance and if the role of lithium is that of a pathway primer, then its deficit would explain a great deal about the neurological dysfunctions associated with low serum lithium in brain tissues.

Conclusion

We tend to think of music as something intangible that is part of the frivolity of life and as something that couldn't possibly have serious effects on the mind or on society, but nothing could be further from the truth. In the case of BPD, the relation of BPD to music may enable us not only to learn more about BPD, but to learn of fundamentally new principles of neurological function as yet unexplored.